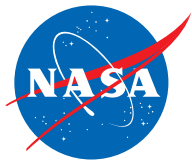


# THE INNOVATION CATALYST



September 2022

## IN THIS ISSUE:

- INVENTOR OF THE MONTH
- Q&A WITH BRYAN GEURTS
- WALLACE TACKLES NASA TECH TRANSFERS
- SPO WORKS WITH OFFICE OF SMALL BUSINESS PROGRAMS
- BOOK OF THE MONTH

## SPECIAL INSERT:

- IT'S A SMALLSAT WORLD AFTER ALL

## TECH TRANSFER TIP

with SBIR/STTR Project Support Specialist Marcus Payne:

The SBIR/STTR program provides U.S. small businesses with the funding needed to deliver technical innovations to benefit NASA's missions, advance science, and stimulate the U.S. economy.



## »» UPCOMING EVENTS:



INNOVATOR HOUR

TUESDAY, SEPTEMBER 13, 2022

1:00–2:00 P.M.





# Inventors of the Month



## DISCOVERING WHAT LURKS BENEATH THE SURFACE

NASA is one step closer to discovering what lies up to 32 feet – or roughly the length of a three-story building – beneath the surface of the Moon, Mars, or other bodies in the solar system. Presently, NASA instruments and conventional radar systems can only probe one or two feet beneath the surface of a planet but can't detect what lies deeper.

Working together, Goddard Earth and Planetary scientists, and a team of Goddard engineers and scientists have developed and fully tested a new type of Spaceborne Synthetic Aperture Radar (SAR) System. This new SAR is capable of taking high resolution images and measurement readings of things such as, ice deposits, lava flows, caves, natural resources, and fluvial or river channels, that lie buried below the surface of not only planets and the Moon, but regions right here on Earth. Mapping and chronicling these otherwise hidden discoveries could potentially help NASA scientists locate regions hospitable to life, and potential sources of water on other planets.

Overcoming the limitations of a conventional SAR system, this Spaceborne SAR architecture can achieve a vast number planetary and Earth survey goals, including the measurement of ecosystem structure and extent, surface and subsurface topography, subsurface stratigraphy or rock layers, soil compaction and freeze-thaw cycles, ice sheet composition and extent, glacier depth, and surface water among many others. The technology presently holds three patents, one for the spaceborne digital beamforming SAR instrument concept, another for a digital beamforming single-pass interferometry technique, and a third for the power reduction of the radar instrument using a Frequency Division Multiplexing hardware and technique.

"This is the future of radar," said Rafael Rincon, the project's lead electrical engineer. "Conventional SAR has been proven and flown and it works really well. This Spaceborne SAR is the next generation of radar and it has a lot more user flexibility. So, this gives us the opportunity to tailor the radar to mission needs, not to tailor the mission to what the radar can do anymore."



Rafael Rincon, Photo Credit: NASA

Conventional SAR is a form of radar that uses the motion of a radar antenna over a given area to create either two or three-dimensional images of the surface. Mounted on an aircraft or spacecraft, SAR uses successive radio waves over a targeted area, and the echo of each pulse is received and recorded. The pulsed waveforms are transmitted using a single antenna which directs the energy to a fixed location on the surface. The phase history of the waveforms are then used to create very high spatial resolution images.

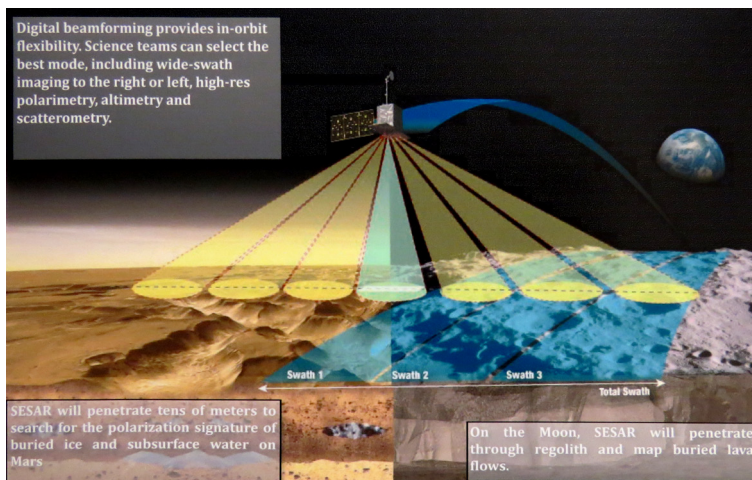
By contrast, utilizing advanced and innovative radar techniques not possible with conventional radar instruments, such as software defined waveforms, digital beamforming and reconfigurable hardware, the Spaceborne SAR provides a much more flexible and capable instrument. Along with Rincon's team, other members of the Spaceborne SAR development team include Goddard bio-research Earth scientists Lola Fatoyinbo and Jon Ranson, and Lynn Carter, previously at Goddard, and now an assistant professor of Planetary Sciences at the University of Arizona in Tempe, Arizona.





Dr. Jon Ranson (Left), Lola Fatoyinbo (Center) and Lynn Carter (Right), Photo Credit: NASA

"We started out to improve SAR by reducing the size, weight, and power of lower frequency radar," explained Ranson of the technology that this year was named First Runner Up for NASA's prestigious Invention of the Year Award. "And we came up with the concept of a so called 'smart panel' cutting edge design, which is a compact panel, that requires less power, is lightweight, and is made of composite materials. This modular multi-panel approach then allows for the customization of the instrument architecture for specific flight missions."



To maximize the science objective of a given planetary mission, SAR's programmable architecture enables it to put the radar beam's energy [or imagery] wherever it wants. Photo Credit: GSFC

What makes the Spaceborne SAR truly innovative and unique added Ranson, "Is the radar waveforms are software defined or focused as opposed to hardware defined and can be steered [or directed] from the spaceship without any moving parts. This means we can reconfigure and shape the radar beam to put the energy [or imagery] wherever we want. So, this enables selectable incidence angles, imaging on both sides of the tract, as well as nadir [position directly below]. This also allows for an increase in the measurement swath area without degrading the measurement resolution."

So far, Spaceborne SAR has been focused solely on applications here on Earth. To get a feel for how this technology works for sequence-system mapping on other planets, it has been tested by taking measurements and images of forest and wetland locations in the U.S., the Bahamas, and Costa Rica.

"We hope the next journey [iteration] for this technology is to the Moon and Mars, where we are going to try and launch these longer wavelength Spaceborne SAR Systems, which will be known as Spaceborne Exploration Synthetic Aperture Radar (SESAR) Systems for planetary exploration," said Rincon. "On Mars we know we can scrape a little bit of the soil off and see ice, but with SESAR technology we can go several meters into the subsurface and see what is there. Commercially, there are other applications that people may want to use SAR for, whether it is for agriculture, urban studies, or looking at subsurface features. That can all be done with this technology and be reconfigured for different applications as necessary. So, that is the real value, I believe, in this technology."



SAR's "smart panel" in Goddard's anechoic chamber, Photo Credit: GSFC



with **BRYAN**GEURTS



Photo Credit: NASA

## ***WHAT TO KNOW WHEN YOU WANT TO LICENSE SOFTWARE***

**A** new software program warrants legal protection as much as a piece of hardware. There are a number of intellectual property (IP) laws that apply to software. To help you understand more about how IP effects software, the Innovative Catalyst sat down with Bryan Geurts, who has served as chief patent counsel at GSFC since 2007. As chief, he is responsible providing legal guidance to SPO regarding its effort to transfer technology, in addition to protecting NASA's IP assets. Holder of a Juris Doctor Degree from Brigham Young University, Geurts has over 30 years of experience in the field of intellectual property law.

### **What IP laws are available to protect software?**

Software is most often protected by copyright law, although in some circumstances patent law can be used. As a general rule, copyrights protect the expression of an idea, rather than the idea itself, which is not protectable. The expression of the idea must be "fixed in a tangible medium of expression" to be afforded copyright protection. That tangible medium might be paint and canvas, in

the case of a painting; a vinyl record, cassette tape, or digital recording, in the case of a sound recording; or, more to the point, a digital memory of a computer program. Thus, once a coder [or programmer] hits "save" for some original lines of written code, that code is protected by copyright. On the other hand, patents protect the functionality of an idea (rather than the expression). Most computer programs we deal with are merely translating known algorithms, equations, or methods into machine readable code and therefore are not eligible for patent protection. However, some programs do have a novel and useful functionality and therefore rise to the standard of patent protection.

### **What is the difference between IP for hardware and software?**

Hardware is simply an apparatus or device that has been designed to accomplish a specific function, and so might be protected by patents if that function is new, useful, and non-obvious in light of other existing hardware. Hardware rarely represents an expression of an idea that's



protectable by copyright, although a few exceptions can be found, (such as Sony's iconic ball and chain transistor radio from the 1970s). Importantly, the copyright in such hardware is not tied to its functionality. Software, on the other hand, is an expression of an idea that has been "saved to memory," much like a photograph, or book, or musical composition. Interestingly, if two software engineers, working separately and without access to each other's codes, were to write exactly the same program, both are entitled to protect their code with an original copyright. This is not the case in patent law, where only the original inventor who files a patent application first is entitled to a patent.

### **Can software be licensed?**

Yes, we [NASA] has express authority to license inventions/patents, but we also can license copyrighted, unpatented software to commercial entities. The difference to a government innovator, unfortunately, is that, while licensed patents entitle inventors to retain a portion of royalties, licensed copyrights do not allow royalty sharing with a software's creators.

### **How do you apply for a patent if a new technology also includes new software? Are you applying for a patent for the new technology as a whole? Could you apply for more than one patent?**

This is a difficult question to answer without a more specific context. In other words, when one of our patent attorneys receives the assignment to protect a software program, the first job is to formulate a strategy to maximize that protection. Sometimes that strategy requires protecting hardware and its related software together as a package. Other times it requires bifurcation of the hardware and software for separate protection. It really depends on the unique circumstances of the case, such as existing prior art, standards in the particular industry, how the hardware and software were developed, and market factors.

### **I understand there are multiple models of licensing IP for software. What is the best for civil servants and contractors?**

As a general rule, copyright licensing of software is done

very much like patent licensing of inventions. SPO is the resident expert in licensing and should be consulted if you create software that you feel could be successfully licensed to a commercial company. We also have other ways to release software to others for varying purposes, including releases to a particular government project and open-source releases. Again, SPO is the responsible office for software release and possesses the Center's Software Release Authority [to select software available for public release].

### **What can be done to make the licensing of software a faster or more effective process?**

As indicated, SPO's Software Release Authority is responsible for implementation of the software release process. Some things to remember when you want to release [and license] software are:

- Complete all forms, including NF 1679 [Disclosure of Invention and New Technology], thoroughly and accurately.
- Engage with the assigned SPO personnel to answer their questions and ask your own.
- Keep track of all parts of the software that are not original to you as accounting for these can slow the software release process.
- Help SPO understand what you want to accomplish with the release [and license] of your software. For example: who is your target audience, are you looking for others to contribute to your software, etc.



**NASA TECHNOLOGY  
TRANSFER PROGRAM**

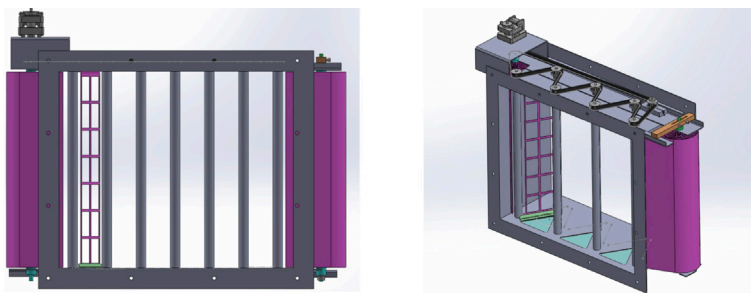
email: [techtransfer@gsfc.nasa.gov](mailto:techtransfer@gsfc.nasa.gov)

# Wallace Tackles NASA Tech Transfers the Same Way he Tackles Quarterbacks

Former NFL Linebacker Aaron Wallace finds tackling NASA technology transfer just as much fun as sacking a quarterback. Wallace, the owner and CEO of Onedrus LLC and graduate from the NASA Commercialization Training Camp, was a recent recipient of the \$15,000 Engineering Design Prize from the Manufacturing Growth and Advocacy Network's (MAGNET) Mspire pitch competition.

MAGNET announced Onedrus (pronounced wonderful) received one of the top two Mspire prizes for developing a new state-of-the-art air filtration device for commercial building applications. The device not only can be easily retrofitted into an existing heating, ventilation and air conditioning (HVAC) system, but through a NASA-developed and patented technology, automatically change its dirty filter media – which filter's the unit's the air – to a clean one, thus saving the customer's time and money.

"The value proposition of the unit we designed," explained Wallace, "is once this system is in place, it can give you some insight into the health of your HVAC system and the quality of the air that is passing through it. And it will service itself. So, when the filter media is dirty, it will automatically scroll and replace it with a clean filter. The ultimate goal is to annually reduce the amount of physical servicing that you would need to do on your air filters."



Filtration device illustration, Photo Credit: Onedrus

Funded by the State of Ohio's Entrepreneurial Service Program and the Ohio Manufacturing Extension Partnership, MAGNET's annual Mspire pitch competition focuses on highlighting a new product that "helps advance the



Aaron Wallace accepting the Mspire award, Photo Credit: Priscilla Diem/NASA

manufacturing industry or is a physical product that manufacturing needs" in Northeast Ohio. The idea behind the Mspire pitch competition, noted Brandon Cornuke, MAGNET's vice president of startups, "is to engage entrepreneurs who have shown tremendous potential to turn their ideas into thriving businesses."

"It definitely was a good feeling to know the people at MAGNET understood what I was trying to present to them," said Wallace upon receiving the \$15,000 prize, which he plans to reinvest in Onedrus. "Air filtration and HVAC is not something that anyone has a lot of knowledge about. So, what I was really able to present, was a [HVAC] problem-solution connection in a way that people can understand."

Wallace, who played linebacker for the Tennessee Titans, Cincinnati Bengals, and Denver Broncos, credits participation at NASA's Commercialization Training Camp back in 2020 for providing him with the impetus to develop the air filtration device and start Onedrus and now win the MAGNET design prize. After spending sev-



eral seasons on the injured reserve list due to injuries that required surgery, Wallace decided to hang up his cleats and officially retire from the NFL in 2019.

"The NFL Players Association has a bunch of different opportunities in the off-season for players to go, do some career building, and try things out," recalled Wallace, a graduate of UCLA. "One of the offerings was attending NASA's three-day Commercialization Training Camp at the Johnson Space Center, which included an introduction into NASA's Technology Transfer Program. I have always liked science and entrepreneurship. When I saw the opportunity, I was excited to sign up for it."

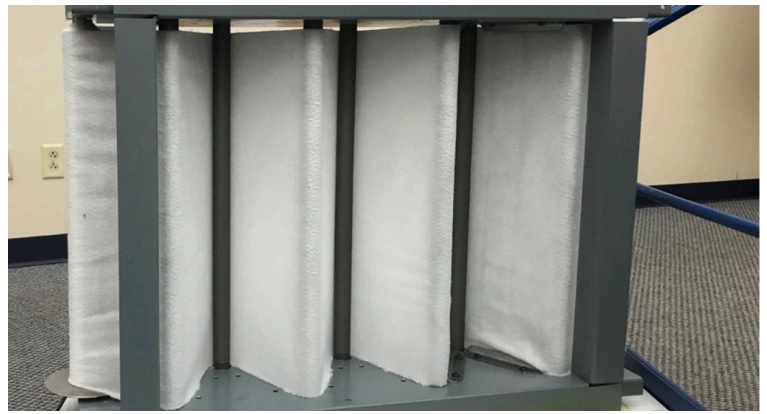
Activities led by Technology Transfer Program representatives showcased a variety of technologies in NASA's portfolio and illustrated different licensing agreements. Players like Wallace received special insights from panelists and guest speakers about startup license agreements, technology mining, and other relevant business resources.

"Many athletes have pursued successful careers as entrepreneurs after retirement," said Dennis Small, technology manager at SPO and NASA training camp manager. "The goals of our partnership with professional associations like the NFL are to provide their members with knowledge of NASA programs and technologies available for business creation. This, in turn, creates more advocates for NASA."

One of the projects Wallace and the other attendees at the Training Camp were assigned to work on was to go through NASA catalogs, do consumer research, and discover what patented products could potentially be used commercially. After investigating a technology for a NASA-patented air filter, Wallace decided there was a plausible commercial use for this NASA technology, which could provide a solution to real HVAC issues.

Wallace explained that the patented NASA air filtration unit design had three stages. But it is the middle or second stage, which according to Wallace, gives his filtration unit's design most of its value. It is in this stage of filtration that his device automatically replaces the dirty filter media with the clean one.

"The Training Camp inspired me to be an entrepreneur,



Filtration device, Photo Credit: Onedrus

create my own business, be my own boss, and find solutions," noted Wallace. "So, I went ahead, formed a company, went through the NASA Startup Licensing process and we have been working on the air filter device since. I would say that one of the biggest things that I have gotten out of my relationship with NASA [and SPO] has been the support from people like Dennis [Small], who still offers me encouragement. I am very grateful for that."

"Once a player goes through NASA's Commercialization Training Camp, that's not the end of their journey with NASA," added Erin Majerowicz, marketing lead at SPO and NASA training camp manager. "We continue to touch base with graduates, like Aaron, to answer NASA tech questions, connect them with others in our ecosystem, and cheer them on through their successes."

Upon being drafted by the Tennessee Titans back in 2016, Wallace said he never would have guessed that one day he would be the owner of an air filtration system start-up partnering with NASA. While confident that he would be successful at whatever he did in life, Wallace says being an entrepreneur gives him the same kind of excitement that being a professional athlete did, but just in a different way.

"I just want to emphasize how grateful I am and how impactful working with NASA and SPO has been," Wallace concluded. "Especially as a former athlete, I am very passionate about athletes finding their second career or next stage of life. The Tech Transfer boot camp helped me find my way when I was searching and looking for what I wanted to do with the rest of my life. So, that Training Camp was very impactful for me. I am very appreciative that NASA is doing things to reach out to people of all different backgrounds and try to get them more involved. I just want to give NASA and SPO a big thank you."

# SPO Works with Office of Small Business Programs to Serve Goddard's Technical Community

In July, Goddard's Office of Small Business Programs (OSBP) successfully partnered with the Strategic Partnerships Office (SPO) to host a booth at the Goldman Sachs 10,000 Small Businesses Summit: The Big Power of Small Business, which took place at Nationals Park in Washington, D.C. During the event, SPO and OSBP introduced hundreds of small business owners to various Goddard and NASA programs specifically created to serve the small business community.

"Small businesses are really the lifeblood of our country and economy," said Jennifer Perez, lead small business specialist at OSBP. "By attending the summit, what SPO and OSBP both showed was our interest in helping to grow small businesses. The summit was a perfect example of how SPO and OSBP share a common interest in working with small businesses to identify significant business opportunities available at the Goddard Space Flight Center (GSFC)."

Summit attendees visiting the SPO booth discovered that many of the technologies developed at Goddard have received patents and can be easily licensed by interested companies for their particular business niche. After speaking with Perez, attendees also became aware that there are many different ways their small business could connect with GSFC.

"I am an advocate for small businesses," stressed Perez. "I ensure that small businesses have the opportunity to compete for government contracts as either a prime or subcontractor. At the summit, I met small business owners

and had them introduce themselves. Then, I explained what we do at NASA and the needs we have. I made connections with many small business owners, and afterwards, many of them directly reached back out to me for more information about partnering with Goddard."

Perez noted that many engineers and scientists at Goddard probably wonder what OSBP does, and how it affects them and the technology they are developing. She explained that, in many ways, OSBP serves as "matchmaker" between particular GFSC technologies and/or services and small business needs.



Jennifer Perez speaks to small business owners at the Summit, Photo Credit: N4 Solutions

"Sometimes I think they look at us and say, 'oh, OSBP is only for helping small business and don't care about the mission,'" explained Perez. "The first thing that engineers, scientists, and technical folks need to understand is that I still work for NASA; the mission always comes first and foremost. But what is important for them to know and understand is: we are going to make sure that they get the very best company to work, partner, or get a contract with."

"I am their gatekeeper," Perez added. "I don't let a small business pass and form a partnership with a Goddard technology unless there is a clear match. Where our technical community can feel safe and assured is that I am going to pick the very best small business that can receive a Goddard partnership opportunity."



SPO and OSBP manning the booth at the Summit, Photo Credit: N4 Solutions





Small business owner meets with Jennifer Perez at the Summit, Photo Credit: N4 Solutions

OSBP's primary mission since its inception has been to increase the representation of small businesses in NASA's contracting efforts in the area of space exploration, scientific discovery, and aeronautics research. That effort encompasses all federally recognized socio-economic small business categories, such as minority or women-owned businesses, and then work to make sure each type of business gets a fair chance to work with NASA.

"The summit was the first in-person outreach event I've attended since the pandemic and it definitely was a great event; I thought it was a well put together venue," concluded Perez. "While the Office of Small Business Programs needs to keep advocating for small businesses, the GSFC technical community needs to also be assured that small businesses fulfill its mission and vision."



Goddard's SmallSat Booth at the SmallSat Conference, Photo Credit: GSFC

## It's a SmallSat World After All

On August 6-11, representatives from the Strategic Partnerships Office (SPO) and Goddard's Small Satellite Special Projects Office (S3PO) hosted a booth at the 36th Annual SmallSat Conference at Utah State University (USU) in Logan, Utah. The conference provided a perfect backdrop for SPO and the SmallSat Team to engage with commercial and government engineers and scientists, researchers, academics, program managers, sponsors, executives, and students from 45 countries in attendance.

With so much activity in the SmallSat arena, it is more important than ever for Goddard to collaborate with members of the SmallSat community in pursuit of the industry's shared goal of further developing architectures to support the Distributed Systems Mission

(DSM) concept. A DSM is a mission that involves multiple spacecraft – such as constellations, formation flying missions, or fractionated missions – to achieve one or more common goals.

"Goddard is always seeking ways to partner with industry to share our technology advancements and to continue to develop the SmallSat platform," said Dr. Christyl Johnson, deputy director for technology and research investment at the Goddard Space Flight Center (GSFC). "The SmallSat Satellite Project Office and the Strategic Partnerships Office are two resources within Goddard that can help attendees license NASA technologies, learn more about our missions, and find ways we can work together."

In addition, GSFC had 20 scheduled speakers at various technical sessions throughout the conference, as well as other presenters taking part in numerous side meetings, which convened during breaks and between events.

"We are thrilled about [NASA Goddard's participation]; they always have a great turnout," said Dr. Pat Patterson, conference chair and director of Advanced Concepts at USU's Space Dynamics Laboratory.

Stay tuned to next month's issue of *The Innovation Catalyst* to read more about the SmallSat Conference.

THE STRATEGIC PARTNERSHIPS (SPO) OFFICE PRESENTS

# INNOVATOR HOUR

Have questions about protecting your innovation?

Want to learn more about how to submit New Technology Reports?

Have general questions about technology transfer and partnerships?

Sign up for a one-on-one 20-minute timeslot with a SPO representative.

Meetings will be held virtually via Microsoft Teams

**NEXT SESSION: TUESDAY, SEPTEMBER 13, 2022**  
**1:00-2:00 P.M.**

#### Available Timeslots

1:00-1:20 P.M.

1:20-1:40 P.M.

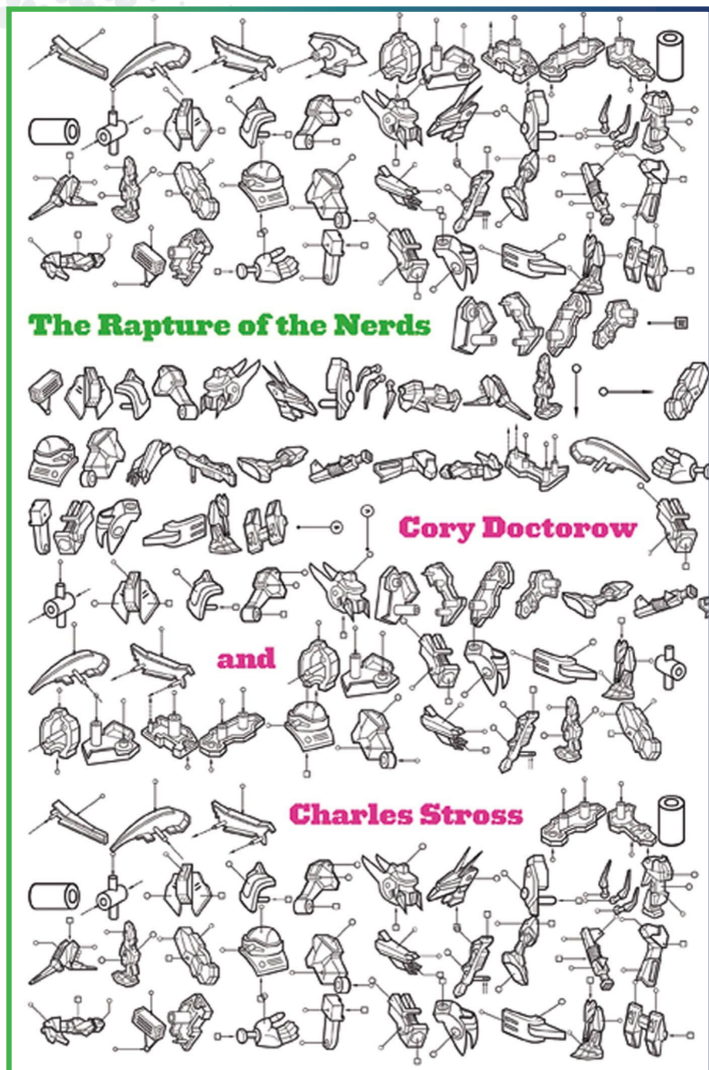
1:40-2:00 P.M.

#### How to Sign Up

To register for the upcoming session and secure your timeslot,  
[complete the registration form.](#)



# THE LITERARY X-CHANGE BOOK OF THE MONTH



Welcome to the fractured future. It's the dusk of the twenty-first century, and Earth has a population of roughly a billion hominids. For the most part, they're happy with their lot, living in a preserve at the bottom of a gravity well.

Those who are unhappy have emigrated, joining one or another of the swarming dense thinker clades that fog the inner solar system. These posthuman consciousnesses have mostly sworn off dealing with their still-human cousins, but their minds sometimes wander. When that happens, they casually spam Earth's networks with disruptive technologies that emulsify whole industries, cultures, and spiritual systems.

A sane species would ignore these get-evolved quick schemes, but there's always someone who'll take a bite from the forbidden apple. Until the overminds get bored with stirring Earth's anthill, there's tech jury service: random humans selected arbitrarily and charged with assessing dozens of new inventions and ruling on whether to let them loose.

Huw, a technophobic, misanthropic Welshman, has been selected for the latest jury. And he'll do his best—despite an itchy technovirus, the apathy of the proletariat, and a couple of truly awful moments on bathroom floors.

(Publisher's Summary)

## WHAT IS THE LITERARY X-CHANGE?

In 2021, the Strategic Partnerships Office (SPO) launched a community library with a little help from Tor Books. Goddard has partnered for years with Tor, a leading publisher of science fiction, by connecting them with subject matter experts to promote the science in "science fiction." Located in the lobby of Building 22, The Literary X-Change is available to the entire Goddard community. Here's how it works:

### TAKE ONE

If a book strikes your fancy take it. Read it, enjoy it, and—when you're done—share it with a friend or bring it back to the X-Change.

### GIVE ONE

Everyone can pitch in to keep the library stocked. Bring books you'd like to share with the Goddard community when you can and continue being a friend of The Literary X-Change!